THE

# FORTY-SECOND ANNUAL REPORT

OF THE

# ROYAL INSTITUTION

OF

# CORNWALL.

INSTITUTED THE FIFTH OF FEBRUARY, 1818.

PART I.

SPRING MEETING, 1860.

TRURO:

PRINTED BY HEARD AND SONS, BOSCAWEN-STREET.

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# ROYAL INSTITUTION OF CORNWALL.

**PATRON.**

THE QUEEN.

**VICE-PATRON.**

HIS ROYAL HIGHNESS THE PRINCE CONSORT,
K.G., G.C.B., K.T., K.P., &c., &c.
*Lord Warden of the Stannaries, and Chief Steward of the Duchy of Cornwall.*

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MESSRS. SOLOMON,
J. B. JOB,
STOKES,
TREGELLES,
W. TWEEDY.

## PROCEEDINGS OF THE SECOND SPRING MEETING,

*Held 11th of May*, 1860.

The Chair having been taken by the President, Dr. Barham, he proceeded to address the Meeting, after which several communications (given in the Appendix) were read, and

*It was Resolved unanimously*,

1. That the cordial thanks of this Meeting be given to those gentlemen who have favoured the Society with Papers or other communications; and also to the Donors to the Library and Museum.

2. That the thanks of this Meeting be given to Dr. BARHAM, for the ability with which he has presided over the proceedings of this day.

## DONATIONS TO THE MUSEUM.

| | |
|---|---|
| Mr. Jonathan Couch, Polperro | Jaw Bone of Delphinus Melos, Leading Whale; Right Ramus of the Jaw of Balæna Rostrata (Beaked Whale). Vegetable Creeper, from Norfolk Island. Grass Bag, made by the natives of Australia for their ordinary use. |
| Mr. Mason | Specimen of Telegraph Wire from Folkestone to Holland. Brooch from Egypt. Ring from Abyssinia. |
| Mrs. W. M. Tweedy | Specimens of Native Copper; Red Oxide of Copper; Copper Pyrites; Uranites; Arseniate of Copper; Blue and Green Carbonate of Copper; Purple Copper; Fahlerz; Tennentite; Condurite; Specular and Magnetic Iron Ore; Iron Pyrites; Carbonates and Phosphates of Lead; Native and Sulphurets of Silver; Sulphurets of Nickel, Bismuth, and Antimony; Carbonates and Phosphates of Iron; Oxide of Magnanese; Oxides of Zinc; Blende and Calamine; Tin Ore and Galena; Cobalt and Nickel Ores; Graphite; Coral; Varieties of Carbonate of Lime; Sulphate of Barytes; Fluor Spar; Wavelite; Quartz; Chalcedony; Opal; Felspars; Epidote; Hornblende; Serpentine. |
| Mr. Richard Pearce | Garnets; Native Copper; Axinite from Botallack Mine. |
| Mr. O. Williams | Locust caught at Perranzabuloe. |
| Mr. Opie | Locust caught at St. Agnes. |
| The Plymouth Institution | Their Report, 1858. |
| Royal Cornwall Polytechnic Society | Their Proceedings, 1858 and 1859. |
| Zoological Society | Their Proceedings, 1858 and 1859. |
| Geological and Polytechnic Society, West Riding of Yorkshire | Their Report, 1858. |
| Mr. S. R. Pattison, London | Letters written to Dr. Buckland on his setting out on a Geological Tour in Cornwall; by Mr. Searle. Tractatus de Corde, 1669; by Richard Lowe, Esq., M.D. |
| Leeds Philosophical Literary Society | Their Report, 1858. Sensorial Vision; a paper read by Sir J. F. Herschel, Bart., K.H., F.R.S., China, and its Trade; a paper read by John Crawford, Esq., F.R.S. |
| Capt. Charles Thomas, Dolcoath | Remarks on the Geology of Cornwall and Devon. |
| John Lubbock, Esq., F.G.S. | An Account of the two methods of Reproduction in Daphne, and of the Structures of the Ephippium. On the Ova and Pseudova of Insects. On the arrangement of the Cutaneous Muscles of the Larva, of Pygæ Bucephala. |
| Mr. H. C. Hodge | On the Caverns and Fissures of the Plymouth Limestone. |
| Mr. George Copeland | Specimens of Fossils from Portland. |
| Mr. F. Annear | Sphinx Atropos. |
| W. P. Cocks, Esq. | Specimens of Natural History. |
| Dr. Carlyon | Spotted Crake. |

# ROYAL INSTITUTION OF CORNWALL.

## THE PRESIDENT'S ADDRESS.

*May 11th,* 1860.

Ladies and Gentlemen; it has not been thought necessary by the Council to present a Report at this Meeting, as that was done at the Annual Meeting in the autumn, when the business of the Institution is regularly transacted. Perhaps it would have been right to follow the precedent of many other institutions, where the President gives a written address, reviewing the progress and advancement of the objects contemplated by the society over which he presides. But I have not had time to do anything so elaborate, and you must excuse me that the few observations I have to offer, are delivered extemporaneously, and you will, I am sure, pardon their imperfection.

I think we may feel pretty confident, from the number of communications we have presented to us to-day, that this experiment of holding a meeting in the spring, and so giving an opportunity once in six months instead of once in twelve months, as was the practice heretofore when all the County institutions held their meetings in the autumn, of carrying on investigations, and of keeping up the interest of the public in those investigations at rather less remote intervals than was previously the case—I think we have every reason to believe that this experiment will be successful. We have several contributions presented by old friends; and I am glad to announce that we have enlisted a very valuable recruit in the person of Sir Gardner Wilkinson, whose name must be well known to you as one of the most eminent antiquaries of the day. He was in the county last year and had been here from time to time before, and, having made various inquiries and investigations as to different antiquities in the county, and more particularly concerning Carn Brea, he formed, what appears to me, as I believe it will appear to you, a very just conclusion, that such investigations would have more interest,

and be more fully pursued, if laid before local societies in the neighbourhood of the particular objects investigated, than if thrown into a central society in the metropolis. I was communicated with on the subject, and I mentioned at our autumn meeting the proposal which Sir Gardner had made to comunicate his researches through our medium, and also to have the illustrations which he had prepared, printed in our reports. The Council thought there could be no hesitation in accepting his offer, and we are to-day in possession of his paper; it must be read now in a somewhat abbreviated form, but it will do very great credit to our Transactions when printed in full. You will also have an opportunity of following his descriptions through the medium of the drawing which has been lithographed for our report, and which will enable you to trace his remarks more connectedly.

In the history of our Institution during the past, as in the previous year, the most prominent feature, and probably the most useful part of its operations has been in connection with the Mining School. At the conclusion of the last session, we thought it desirable, with a view partly to bring our chemical teacher, Mr. Pearce, up to a full level with the present most advanced processes in chemistry and metallurgy, to let him have a course of instruction and practice at the Government School, in Jermyn-street. He attended there three months, and, more especially, he attended the laboratory practice of Dr. Percy; and I have had the pleasure of seeing a letter from Dr. Percy, in which he speaks in the highest possible terms of Mr. Pearce's capacity and diligence, and expresses a wish that he should hereafter, if we could spare him, become an occasional assistant of Dr. Percy, in carrying on his course, and also intimating his desire for a cordial co-operation between our Mining School and the central one in London. I must not omit this opportunity of conveying the thanks of this Institution to Dr. Percy for the very liberal terms on which he received Mr. Pearce as a pupil; he remitted a large portion of the fees, and made it altogether easy to us. I have no doubt you will feel that if it is possible to keep up that inter-communication between this Institution and the Mining School in Jermyn-street, it will be mutually beneficial, and that in process of time we shall also be able to assist them as to some local points on which they cannot be so fully informed. Since Mr.

Pearce's return from London, a class for laboratory practice has been formed here, and has been carried on for two or three months. That class, though not very largely attended, has been, I am quite sure, very advantageous, both with reference to the individuals who attend it, and for the opportunity it affords Mr. Pearce himself, to carry into practice what he had acquired in Jermyn-street, and moreover in keeping up fully his acquaintance with Cornish minerals. We think, as we have thought all along, it will hereafter be exceedingly desirable that there should be a central course for the more advanced study and practice of metallurgy; but, at the same time, the result of our experience is, that the main efforts of our Mining School must be directed to the local mining districts, and must have somewhat of a migratory character. You will be glad to hear there is every prospect that this sort of migratory Mining School, such as was carried on last year at Pool, at Camborne, and at St. Just in Penwith, is likely to be very cordially received in other mining districts, more especially at St. Agnes, where application was made some time ago for the assistance of Mr. Pearce, and where preparations have been made in a very liberal spirit for his reception. It is proposed that, as soon as the course is closed here—in a few weeks, a class shall be opened at St. Agnes and continued there for about two months. After that, it is intended that Mr. Pearce shall resume his work at St. Just, where he has been warmly invited to renew the teaching which was so well received last year. There is every reason to believe that in successive districts of the county, in this way, we shall be rendering most valuable assistance to the working miner, and to the junior mine agents.

In the autumn of last year, you are aware another combination for a similar purpose was made under the auspices and through the influence of Mr. Hunt. It was entitled the "Miners' Association." That started well; and I am sure we shall all sympathise with the movement, and wish it most heartily success. It is perfectly clear that everything of that sort, so far as it actually works, must assist our efforts. The difficulty attending all mining school schemes has arisen from what may be called the apathy of miners themselves. There has not been offered them the particular article they wanted. Nothing will give us more pleasure and greater satisfaction than to see they are alive to the importance of science in relation

to mining pursuits. I think all who have had to do with the successive mining schools have been anxious—certainly we are so now—to derive hints from working miners, and to give them what they want. We may have a notion of our own that we are a little in advance of them in certain respects; but at the same time we are anxious to meet them on their own ground. It is proposed that Mr. Pearce should work in those several districts in connection with the Miners' Association, and we shall be exceedingly glad to co-operate on that principle. The difficulty in the way of success has chiefly arisen from the comparative indifference of miners themselves to this species of knowledge; and I am afraid there is still a great deal to be apprehended on that score. It has been found that since the establishment of the Miners' Association in the autumn, nothing has been done during Mr. Hunt's absence; there seems to be rather a want of spontaneous movement on the part of the mining interest. But I trust that when the spur shall be applied by Mr. Hunt, something will be done. One of our friends, Capt. Williams, of St. Austell, who has contributed some interesting papers to our Transactions, wrote to me the other day with reference to mining education. It seems that in the district of St. Austell, he, in connection with other friends, made very strenuous efforts for the establishment of schools among the miners. Among other things, he had, at his own cost and that of his friends, established a reading-room, and deposited there books, newspapers, and so on—the room being open, entirely without charge of any kind, to miners and to any one who chose to make use of it. Capt. Williams writes:—"I engaged a master from Pool, and, in connection with the school, had a good room provided with newspapers, periodicals, and a good cabinet of specimens; and Mr. Pearce, of the Truro school, kindly gave a lecture on chemistry; but although the reading-room was thrown open free to all the labouring miners for nearly two years, I do not believe that the attendance, in total, would amount to 100 persons in that time." He goes on to state that the school has in fact been a failure.

Under these circumstances, it is very evident that the school-master must not be abroad, but at home. We want some preliminary sense of the value of knowledge, and some preliminary capacity to receive it, before any great deal can be done. Our object is, in working our own school, to keep up a pretty high

standard of acquirement by devoting about three months to a course of lectures and laboratory practice in this place; giving facility at the same time for such analyses and assays of minerals as may be the means of turning to account any new discovery that may be made in this county; and that during the other three quarters of the year our teacher should pass from district to district, giving such preliminary instruction as may be suited to the present wants and present capacities of the younger miners. I think there is evidence of co-operation, not only on our part towards the Miners' Association, but on the part of the Miners' Association towards us; which is something better than we have hitherto experienced. Among the signs of that goodwill, I had the pleasure of receiving the other day a letter from Capt. Charles Thomas, who may be considered a fair representative of the Miners' Association. While he communicates his intention to double his subscription to our Mining School here, he says he does so, "with the hope that Richard Pearce may be employed in the diffusion of the knowledge he has acquired, among the young miners, either in the present Mining School, or in the proposed Miners' Association, or both jointly." That is the view I myself have taken, and some of my friends I know quite concur in it—that Mr. Pearce, who is really a chip of the mining block and certainly competent in every way to carry out his particular course of instruction and the views of the Miners' Association as well, should be employed in the way suggested. Nothing can be done without a working man as a teacher. It is vain to attempt to convey instruction by amateurs, teaching merely as a matter of taste. You must have a man who earns his bread by it, whose object it is to make his profession of teaching successful. Our view cannot, I think, be better represented, than in a few lines we have had from Mr. Palmer Budd, who, while he continues his liberal subscription of £10 a-year to our scheme, says:—"I do not think it necessary that all working miners *should* acquire scientific knowledge, but that all *may* do so. Like in the French army, it is sufficient that every private soldier *may* become a Field Marshal, and that means are provided by which the *sous officier* who emerges from the ranks shall qualify himself for the higher grades, so it will be sufficient to elevate gradually the whole mining class, that ready and accessible means are within the reach of the few who will avail themselves of them; and as

masses of men do not change suddenly, we must not be impatient, but be satisfied if we see that ours is a period of elevation, not of degradation." That seems to me exactly the principle on which we as an Institution ought to act with reference to this particular question.

I am glad it is not my painful duty on this occasion to have to refer to the loss of any of our members or fellow labourers. I should not have alluded to the subject at all, except for the purpose of communicating to you something that may serve to lessen the disappointment which many persons have felt at the want of that lithograph of the portrait of our late lamented president which was expected by the subscribers. It seems there was such a failure in the lithographic process in the copy that was made in London, that though the prints were sent down, they were really not such as would have given satisfaction to the subscribers, and, therefore, they were thrown aside. I had a communication the other day from Mr. Sydney Hodges, of Falmouth, in which he says—"I fear I shall not be here on the 11th, but I can set your mind at rest about the portrait. Hullmandel has just completed a much more satisfactory lithograph of Mr. Tweedy, which will probably be issued in a few weeks. Mr. Phillpotts' absence, and one or two other things, have delayed it. Of course, it was no fault of ours that the first was so bad; but for this it would have been issued long ago."

Among the works which we have generally undertaken as an institution established for the promotion of Natural Philosophy, as well as the investigation of Natural History, Meteorological Observations have occupied a considerable portion of our attention. I shall not delay now by entering into any minute details with regard to the Meteorology of last year; but I cannot altogether pass by the subject, inasmuch as the last year has presented perhaps the most remarkable features of any year we have on record. The temperature of the summer was the highest that has been recorded since any accurate observations have been made. The Registrar-General, represented by Mr. Glaisher of the Royal Observatory, states, in speaking of July last, that the mean temperature of the month was remarkable; it was 68·1; the average mean temperature of that month being 61·4; so that there was an excess of temperature, of 6·7. The temperature of July month was also very remarkable in another

respect. The highest monthly temperature for nearly 80 preceding years, was 67°, in 1788; which was exceeded last July by 1·1; so that the temperature of July last, stands out as the highest monthly temperature as far back as any trustworthy records extend. Then, in opposition to that highest temperature, we have, at the other extreme, in December last, the lowest temperature ever recorded in Cornwall. I believe in different parts of the country east of Cornwall, the temperature was not quite so low as it had been in two or three instances before, since meteorological records have been kept. But here (in Truro) the temperature fell to 9° above zero; and that too in our little observatory above, which is a wooden building roofed over so as to prevent radiation into the sky. There is no doubt that if the building had been roofed with glass, so as to allow free radiation, the temperature would have sunk several degrees lower. It is very remarkable too, in this county, how greatly the temperature has differed at places at comparatively short distances from each other, and consequently how the extent of injury to plants and vegetables has varied in neighbouring localities, in some being very trifling, in others causing perhaps unprecedented destruction. At Helston the lowest temperature was 22, being 13° higher than here; and it does not appear to have been lower than that at Penzance. At Scilly it has not fallen below 32; for four nights it was as low as 32. There is a remarkable circumstance in relation to the temperature at Scilly. The observations at St. Mary's were made by Mr. Moyle, surgeon, who registered the temperature of the sea also, and it would seem that, at St. Mary's, the temperature of the water was actually rather lower than on land; while the temperature on land was 32, that of the sea fell to 31 and 30. But at the Seven Stones Lightship, where, at our request, observations have been made by direction of the Trinity Board, and forwarded monthly to Mr. Whitley, the temperature of the sea was remarkably high; it did not fall below 52; it varied only between 53 and 52; it was wonderfully equable, and 20° higher than that of the air; the temperature *in* the lightship sinking to much the same as that at St. Mary's—it fell to 33 at 9 a.m. So that it would seem the lightship must be in the way of some considerable branch of the great current from the Floridas—the gulf stream; while the water observed at St. Mary's must be a little out of it,

and the sea must have been chilled by a comparative stagnation in a shallow bay. This period has also been very remarkable for the occurrence of earthquakes. Last year and the beginning of the present year were signalised by two of the most remarkable shocks of earthquake ever experienced in this county. The first of these earthquakes—on the 14th of October—was preceded by one of the most brilliant Auroras observed for many years past. You will have some observations presently on a peculiar whirlwind that occurred about the same time. The earthquakes will be dealt with at some future time by Mr. Edmonds, who has taken our earthquakes in charge for many years.

Among the objects on the table, I will draw your attention to one as being the work of a townsman of ours, who has distinguished himself highly in his department, and who has been marked out by Her Majesty for the honour of knighthood—Sir Henry James. He has sent us specimens of a most beautiful art which has been brought to perfection in the Ordnance Office at Southampton, under his superintendence. It is called Photo-zincography. I will read a few lines that accompanied the present of these specimens, to Dr. Carlyon:—"We have just brought an art, which I have called Photo-zincography, to great perfection; we can take a photograph of any document, in such a way that it can be transferred either to zinc or stone. This promises to be of great importance, and I expect shortly to have to copy Domesday Book, the Pipe Rolls, and the Patent Rolls by it. As we print from the zinc plate, as in ordinary printing, the cost will only be about a half-penny a sheet." It seems to be a very valuable art, inasmuch as it insures perfectly accurate copies of those ancient documents—*fac similes*, such as cannot be procured by any other means.

I would also call attention to the labours of two of our members on a subject that has attracted much attention during the past year, and certainly it is one of the most interesting subjects that has been discussed by the geological world for a long time—the discovery of works evidently formed by man in connection with particular geological strata that are supposed to be of more remote antiquity than is usually assigned to the human species. Two of our members have contributed to the elucidation of this subject. One of them, Mr. Hodge, who was here in connection with the late Mining School, presented a

paper, of which I have a copy here, to the meeting of the British Association at Aberdeen, in which he has directed attention to the particular conditions of some bone caves in the neighbourhood of Plymouth. The paper shows a deal of ingenuity, particularly in the application of chemistry to the explanation of the special conditions of certain caves, and he thus fixes at a rather less remote period the dates at which the bones were probably washed into the caves in question than would have been assumed from the geological character of the rock. The paper is highly creditable to Mr. Hodge's ingenuity. Another labourer in that department—one who also belongs to our society and whom we have known as a contributor for years —is Mr. Pattison, formerly of Launceston, but now settled in London. He is a very able geologist. I have a letter from him, which arrived only yesterday; and probably it may be better that I read it now than that it be regarded as a formal paper. I think you will find it interesting.

London, 9th May, 1860.

Dear Sir,—I have nothing to offer for your approaching meeting worthy of attention, but the suggestion that the attention of members may be drawn to the quarternary deposits of Cornwall, in their relation to the human period, as affording a subject for investigation of present interest and importance.

1. The earliest stratum of the quarternary in Cornwall, appears to be the tin-gravel, a torrential deposit of local origin, resulting from action long continued in the course of the present valleys, when they were much more elevated above the sea than now. The absolute date of this, cannot, of course, be ascertained, but we get an approximation to relative date as we ascend. They lie on the granite or upturned edges of the killas, both which had been subjected to partial decomposition, but do not appear to have been covered by any other palæozoic, or any secondary or tertiary deposits.

II. The next is the forest bed, which lies immediately over the stanniferous gravels, and passes under the present sea level, forming the numerous submarine forests, common to both sides of the English Channel, and to the east coast of England. This is undoubtedly older than the boulder clay (which I have seen at Gorlestone resting upon it), and probably of the same age as the old mastodon beds. This forest bed forms an excellent horizon, as it maintains nearly the same level everywhere with regard to the existing sea. It has a vegetation suited to the zone in which it is now found, but not suited to its present actual site. The

sea-margin was not then the same, and Cornwall and Brittany must have been nearly, if not quite united. The whole series indicates a succession of occasional depressing movements of the land, until the sea was brought someway within the present coast line, filling the mouths of the valleys with silt.

III. Upon this lie the terraces of shingle forming the old sea margins. Probably three successive stages can be read off around our present estuaries and bays, as indicated by Mr. Godwin Austin, in his paper on the English Channel, in the Journal of the Geological Society of London. This epoch is synchronous with the formation of an irregular bed of re-constructed tin-gravel, more local and disturbed than the former, not like it, lying on the fundamental rock, but on previous aqueous deposits, and poor in tin. It is also the epoch of the great formations which, under the names of the glacial and drift period, and post-glacial mammalian period, have left such ample traces in the east of England. A series of elevatory movements characterised this epoch, closing with the attainment of the present relative levels of land and sea.

IV. Lastly, we have the present surface unchanged throughout historic time, as the most ancient earthworks testify, save by the crumbling touch of old Kronos himself.

I have not noticed the gravels of the Lizard district, which I have not seen; nor the mottled clays and sands of St. Agnes, which appeared to me to be a relic of lower green sand.

Hitherto we have been accustomed to consider all traces of humanity confined to No 4, but I find in Sir Henry de la Beche's Report (p. 429) that he somewhat loosely assigns some flint implements to the age of the tin-gravels, and Dr. Winn, in a paper in your proceedings for 1839, affirms the still more startling discovery of axe-marks on a log of timber in the old forest bed. The relative dates of these deposits, as above indicated, throw into absolute shade the more recent discoveries of flint implements in the freshwater shingle of the Somme valley, and the human remains in the volcanic gravels of Auvergne; for the latter are confessedly long subsequent to the boulder clay, and nearer to our own time, whereas the former (if they can be established) will effect a total overthrow of all received opinions on the antiquity of man upon the earth. I would therefore suggest a re-examination of the evidence afforded by the Cornish deposits, for if the instances adduced are from disturbed drift beds, they afford no such evidence as they at present seem to indicate.

This pursuit is now all the more tempting, as it is allied to the archæology of implements found in barrows, for if the latter can be shown to be similar to the flints from Amiens, it will much

elucidate the vexed question as to their history. I trust some one of your members will undertake the investigation for the sake of Cornwall and of truth.

Yours faithfully, S. R. Pattison.

As an allusion is here made to a valuable contribution from Dr. Winn to this Institution, printed in our Report for 1839, I have brought here the particular articles which he then presented. In the first place, there was a large vertebra of a particular species of whale—*Balœna Mysticetus*—and a rib of the same, about 7 feet long, which were found on a bed of sea sand, about thirty feet below the present level of the sea. With these, Dr. Winn sent some remains of wood. The part referred to by Mr. Pattison is thus spoken of in Dr. Winn's paper:—"Amongst the vegetable remains that I procured from Wheal Virgin, and which lie on the table, there is a piece of semi-carbonized wood which was removed from a large trunk of an oak, that exhibited a peculiar fact which may be worth noticing. The tree was imbedded in the upper portion of the tin ground, in a horizontal position, and on its upper surface, about eleven feet from its extremity, there was a large angular notch which must have been formed by a hatchet or some other sharp instrument." You will see the bearing of that statement on the question of the contemporaneous existence of man and this particular oak, found just above the tin bed. But the question is one which requires very much further investigation, to know what period of time was required to make such a deposit, first of the tin-stuff—next of the overburden, as it is called, of silt, which, in some places, has reached to an enormous depth. We have brought together a few articles found on tin beds, or above them, in stream works, to illustrate this particular question. Here, in the first place, is a pretty specimen of a wooden bucket or measure, presented by Sir Joseph Sawle, together with this rusty celt; both which were found in Wheal Virgin tin stream work, in the valley running southward from the town of St. Austell to the sea at Pentewan. They were discovered in the tin ground, about 28 feet from the surface—the measure on the 15th May, 1851; the celt in April of the same year, and they were carefully preserved by Capt. William Bray, manager of the stream work. They are, very clearly, works of advanced human art, and they were found in a situation in which, no doubt, they were originally placed; they had not been washed

into any pit or cave. We have here a brooch, found ten feet below the surface, on Goss Moor; and a metal bowl found at Carnon, and presented by Mr. Henwood. But what, perhaps, illustrates dates better than anything else, here is a crucifix, found in 1812, at the bottom of Carnon stream works, about 30 feet under the bed of the river. You are aware that crucifixes are articles, geologically speaking, of very modern date. The fact of its being found 30 feet below the then existing bed of the river, seems to show more than anything else, the extreme rapidity with which the deposits are formed in certain favourable situations. We know that Carnon Valley is situated at the outlet of the great mining districts, from which the amount of silt washed down is very considerable. The silt and gravel is from 40 to 50 feet deep. So that in this comparison of articles found, in connection with the geological conditions in which they are found, we have two things to take into consideration. First, the period during which the former sea-level has subsided below the existing sea-level; and in some places it appears that the former was from 30 to 50 feet below what it is now. And, then, there is another branch of inquiry. How long it would take to fill up these valleys with this kind of silt? These points must be settled before we can come to any conclusion. The question is one which is particularly agitated just now among geologists, and it is also interesting to the general public, as it bears on the assigning a date to the existence of the human species on earth; and it is highly desirable that some of our friends should investigate it, and bring us their conclusions at some future time.

# APPENDIX I.

## CARN BREA (OR CARN BRÊ),

### NEAR REDRUTH, CORNWALL.

By Sir GARDNER WILKINSON.

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The beauty of scenery, or any general quality possessed by a particular site, may be described in such glowing terms as not only to lead to disappointment, but actually to induce some persons of hasty judgment to deny altogether the very merits, which they would willingly have conceded, had they paid an "impromptu" visit to the spot; thus, the description of some ruins on the road to Berenice, given by Caillaud to Belzoni, which he likened to those of Pompeii, prevented the anxious Italian from seeing anything of interest in the place; he would not even dismount from his dromedary to examine the ruins of Sakáyt; and his innocent guides were subjected to his indiscriminate censure. This has in some degree been the fate of Carn Brea; and the glowing description given of it by Borlase, who fancied he there saw Cromlechs, a grove of oaks, a judgment-seat, and numerous peculiarities of a place of Druid worship, led others to deny the existence of any remains on this remarkable hill, and to dismiss the whole account, as fabulous, without proper enquiry. The truth, as usual, lies between the two statements. The summit of the hill (which is said to have an elevation of more than 700 feet) has been fortified with stone walls; composed in some places of large blocks, many of which are placed upright; and the camp consists of two principal parts, that to the west known as the "Old Castle," and that to the east occupying the larger portion of the whole upper enclosure, and separated from the former by an inner wall.

Its name is derived from *Carn* "a heap of stones," and *Brê* "a hill." *Carn*, as is well known, is frequently applied to any eminence on which stone remains are found; and the large fortified town of *Carn Goch*, "the red heap of stones," in South Wales, and other extensive stone ruins marked by the name "*Carn*," show that it indicated the remains of walled towns, as well as the heaps of stone raised as memorials to the dead.* The name Brê (erroneously written *Brea*) is very general in its application to a "hill," and without citing numerous examples, I shall content myself with two: one of which is *Dwy*, or *Dau-brê* (the Roman *Dubris*) "two hills," the name of Dover; and the other Bredon-hill,† in which the modern name is the same word thrice repeated: *Brê* "hill"—*Don* or *Dun* "hill"—and the English "*Hill*," reminding us of *Il puente de Alcantara* in Spain, which signifies "the bridge of the bridge."

Borlase thinks that the walls of this place were not intended for defence, and that they have no ditch on the outside; which he brings forward as an evidence "of this hill's being dedicated to the service of religion; the design of this low defenceless mound being to separate the sacred groves from common use, and to prohibit, not only cattle, but all persons profane * * * from entering upon the consecrated ground;" and he instances "a mound of this kind round the stone circles at Abury" (p. 118). But it will be seen, by comparing his plan with the one here given, that he has omitted all notice of the outer wall; and the inner one he here alludes to (marked by him A K) is really a wall of defence, and totally unlike the agger at Abury; which last, while destitute of a ditch on the outside, has a very deep one within it, separating it from the platform on which the sacred circles stood. It, therefore, bears no resemblance to that at Carn Brea. Besides, the agger at Abury is on a

* This is the general meaning of *Carn*. Some have supposed *Carns (Carneddau)* to mark the burial places of malefactors: but this is opposed to the known custom of raising mounds of stones (or of earth) in *honor* of the dead in so many countries; and the saying in Wales respecting a good man, "I am sure everyone would carry a stone to his grave," like that in Scotland, "I will add a stone to your *carn*," sufficiently proves the custom, and the object of this kind of monument. Its conspicuous position is also more in accordance with a mark of honor; and the improbability of people toiling to the top of the highest hills, to heap stones over a malefactor's grave, is obvious.

† This is in Leicestershire (on the confines of Derbyshire); and there is another hill of the same name, with a camp upon it, in Worcestershire.

level plain; while that of Carn Brea is so placed as to take advantage of the fall of the ground; standing as it does, on one side, on the very edge of a nearly precipitous hill, and in all parts commanding the ascent. This, and the number of outer defences on the weaker side to the south, where the ascent is gradual, with the single wall on the steep northern side, at once proclaim that it was intended for a defensive purpose; and it is, therefore, unnecessary to bring forward any further proofs of its having been a fortified place. Indeed, I find from the many camps of British time, of which I have made plans, that it exhibits the same general principles of fortification; one of which was to follow, and take advantage of, the form of the ground wherever it was most precipitous, and best suited for defence. For it is a mistake to suppose that all British camps are *round*; the circular form was the one preferred if the ground was suited to it; a perfect *rectangular* encampment may be at once pronounced not British; but by far the greater number of British camps were of irregular form, according to their position, and the shape of the hill; with a general inclination to curved lines, whenever they could be judiciously introduced. And the outer enclosures were as varied in form, size, and direction, as the high grounds on which they were placed.

Though they might appear of little importance from a passage in Cæsar, where he says—"the Britons call it a town *(oppidum)* when they have fenced in a wood with a trench and ramparts;" this impression is removed by his stating that some of their strongholds were admirably fortified by nature and art *(natura et opere)*, having been prepared before, during their domestic wars (B. G. v. 9, 25); and by his admitting that to take them, the Romans were obliged to use the *testudo*, and to throw up a mound against the works *(aggere ad munitiones adjecto)*. Such expressions show that their defences were of the nature their remains now prove them to be; and the number we still meet with, accords with the account of so many afterwards captured by Vespasian. Tacitus also mentions the stone wall thrown up by Caractacus, and the defences on hill-tops. But my space forbids my entering into the long and interesting question of British fortified camps and towns; and I must limit my descriptions of them

to the one immediately before us; in doing which I shall call attention to some other remarks made by Borlase on the peculiarities of Carn Brea.

With regard to the judgment-seat he mentions, and figures (p. 119, pl. vii fig. A H, Z), and in which he finds several seats, or benches, of justice, I think he is not justified by its appearance, or its position. The natural Carn (at Z in his plan) with a flat canopy-stone overhanging, is simply a rock which from its site was found useful to form part of the second line of defences; and the "row of pillars" with which it is "fenced" is only a portion of the wall, which continues in front of the rock, and extends beyond it to the east and west. Indeed, this wall does not form part of the main, or innermost, circuit; it is merely one of the outer lines of defence; and we can scarcely suppose, if this had been the site of a judgment-seat, that it would have been in so exposed a position, close to the wall of one of the outworks of the place, in preference to so many more secure spots *within* the inner defences of the town itself. (See E in my plan.)

Again, the "serpentine figure, which in the volute of its scroll has two very high and large stones set on end," is no other than a portion of another outer wall; which curving in that part continues to the eastward below the hill, and serves (as may be seen in my plan, at C) for another line of defence. And though the earth has been much disturbed, in some places, by later excavations for stone, its direction may still be partially traced; and the large upright blocks mentioned by Borlase are similar to others found (as he indeed admits) in the same locality (to the east and west of B, in my plan), which were part of the outward defences. Others, again (at A in my plan), were designed to protect the gateway of the town itself; and to cover the approach to what he very properly calls the "entrance passage."

All these indicate a defensive and military purpose; and the method of fixing stones, at intervals, erect in the ground, which effectually prevented their being thrown down suddenly by an enemy, was evidently one style of wall-building adopted in those times. It has even been imitated in much later days, both in Cornwall and Devonshire. The stones were placed like a row of slabs, or pillars, sometimes close together, sometimes

at short distances from each other, to serve the purpose of vertical binders, the spaces between them being filled in with other blocks placed horizontally, or in the position best suited to their shape.* The intercolumnar space thus filled with solid masonry formed a very strong wall; and as an enemy could, by throwing down blocks placed horizontally, encumber a passage, or create standing ground for an escalade, the massive stones fixed upright in the ground were sometimes preferable; and we readily perceive the reason why they were selected for covering the approach to a gateway, and how useful they were in enabling the besieged to retire in safety after a sortie.

These "stones erect" then, which formed part of the walls, had no religious idea connected with them, as Borlase supposes (p. 120); and were of a totally different character from the "long stones" *(Maenau Hîrion)* attached to avenues, or erected for purposes connected with the temple, or the tomb. And though I do not doubt the existence of Druids, or of Britons, in this island, as some seem disposed to do, I cannot find in Carn Brea any evidence of its having been a "religious," "not a military," structure.

A small "brook at the bottom of this hill" may have been called "the Druid's ford" *(Rhyd Drew)*; and the name of Redruth (or according to others *Tre-Druth* "Druid's Town") may have had the same origin; but neither of these tend to disprove the military nature of the fortified works of Carn Brea; and the very fact of this hill not deriving its name from the Druids argues against the exclusively religious character of the place. All that the traditional name Redruth can suggest is, that some sacred monuments of the Druids may have been in the neighbourhood; and they very probably availed themselves of the security afforded by this strong fortress; retiring

* Some have thought that the intercolumniations between the upright stones of sacred circles were once filled up in a similar manner; but this is evidently a misconception, as no vestiges of the materials remain. Nor were the spaces between them covered over by a lintel stone (forming trilithons) as in the outer circle and centre of Stonehenge; which are of later date than the smaller inner circle there probably added by the Belgæ. Nor was this trilithic arrangement usual; and the unequal heights of the blocks, in many circles, show it to have been generally impossible. Thus one stone in that near Castor is 8 feet high, while the two to the right and left of it could not have been more than half its height; and in other circles, as at Stanton Drew, the space between the stones would have been inconveniently great.

to it in times of danger, and performing sacred rites within its precincts, as priests of many religions have done in other strongholds, without converting them altogether into holy places, or depriving them of their military character.

The summit of the hill of Carn Brea is of long and irregular shape, terminating to the eastward in a mass of rugged rocks. The whole area enclosed within the upper or main walls measures 1040 feet in length east and west, by about 600 in the greatest breadth north and south, and consists of two principal parts; the smaller one of which, to the west, may be considered the keep, or citadel, and measures about 280 feet east and west, by about 230 north and south. These two occupy all the upper surface of the hill, exclusive of the rocky part to the east already mentioned; which being about 540 feet in length (with a breadth varying from 250 to 90 and 40 feet) makes the total length of the summit of the hill 1580 feet. On one of the masses of rocks in this outer part the Mediæval Castle stands; but it is an object of little interest; and that it cannot occupy "the site of one supposed to have been erected by the Britons" is evident from the plan of a building* measuring about 50 feet in length by less than 12 feet in breadth, varying with the irregularities of the rocks on which it is perched; and from the fact of towers, or castles, of this form having been quite unknown to the Britons.

The upper walls enclosing the fortified area of Carn Brea are not the only defences of the place. They are seconded by outer walls and embankments, extending along the whole south side of the hill, and abutting against the high rocks at its eastern and western extremities. On the south-east of the main wall three outer lines were thought necessary; in one of which, at B, is a gateway, immediately below the main wall which flanked and protected it, and in another the gateway D; both which are admirably placed for preventing the besieged, as they retired after a sortie, from being harrassed by a pursuing enemy. And the lofty overhanging rocks to the left, the sinuosity of the covert way, and the curved wall on the salient eminence to the right of D, as they entered, effectually covered their retreat. Between C and C G was the outer approach, or

* See the plan on a large scale in Borlase, pl. vii, fig. A D. It has been slightly altered since his time.

covert way, leading to the gates B and D of the outworks, and to A the main entrance on this side; which last (as I have already shown) was protected by a narrow passage formed of strong upright blocks of stone, forming part of those counter-guards, which were most required for masking the gates. These advanced works for covering the approaches, and for protecting the besieged during a sortie, are frequently met with in British fortified camps, where they are often constructed with great skill; and the covert ways, sunk in what we should call the glacis, display a thorough acquaintance with the general principles of attack and defence.

There was also another gateway at T; and some masonry at Y about 60 feet within it; but it is difficult to say whether the latter was connected with the approach, or even whether it was of the same date; and at Z are several large upright stones, which once formed part of the wall and of some advanced works belonging to it. Another vallum, mostly of earth, at H and W, formed the exterior line of defence on the south, and sweeping round to the east and west, joined the rocky extremity of the hill at those two points; there appears also to have been another outer ditch and vallum some distance beyond, though of no great importance compared to the other defences of the place.

Three very distinct lines of circuit are of frequent occurrence in British forts, which were intended to add to their strength as well as to receive the cattle and flocks during a period of alarm; which, when a decided attack was made, were collected within one of the outer enclosures; two of these being always formed before the body of the place, and generally before the main entrance; and this custom of driving the flocks into the forts accords with the statements in Cæsar of the numbers found in British camps, when captured by the Romans.*

They were also strengthened by palisades, like the rest of the works; and in some of these forts we find certain places of peculiar construction which were evidently secured by those means; illustrating in a most satisfactory manner the accounts given by Cæsar of the great use made of stakes by the Britons

* Cæsar, speaking of the capital of Cassivelaunus, says, "Quo satis hominum pecorisque numerus convenerit." He also speaks of their towns defended, "vallo atque fossa;" and when taken he finds in them "magnus numerus pecoris."

in their military positions, both in fencing their towns and in securing the passage of a river; but these are details which would require to be explained by a long treatise on their system of defence, and by numerous plans, which cannot here be introduced.

On the north side of Carn Brea the steepness of the hill rendered extensive outworks unnecessary, as the main wall frowning over the ascent commanded the approaches on that side; but advantage was taken of all the salient points, as at Q, Q, Q, for enfilading the walls by what we should call a flanking fire.

Little is, therefore, worthy of notice on the north side except its natural strength; but I may mention a well at O immediately below the main wall, and another at S, which still contain a supply of excellent water; and at R, on the north side, there is a large fissure in the granite rocks, called "the house of water,"* which has a total length of 145 feet. It is of considerable depth, being, as Mr. Wade, of Redruth, informs me, 36 feet at the deepest part in the middle of April; and the quantity of water it contains is the more remarkable as so many wells and springs in the neighbourhood are drained by the numerous shafts in this mining district.

It has every appearance of having been an ancient mine; a conjecture which is confirmed by general opinion, as I learn through the kindness of Mr. Wade and Mr. Downing, of Redruth; and I have seen other shafts in Cornwall of early time which are formed in a similar manner, the granite rocks being left like a wall on each side of the lode. I do not, however, believe this mode of mining to be British; and from what I have seen of their mode of proceeding in Wales and other places, it is evident that the Britons scooped out and carried away the whole of the rock, or hill crest, in which they worked; sometimes to a depth of from 100 to 200 feet, on a superficial extent of 120,000 square feet. Such are the dimensions of the largest working at the gold mines of the Ogofau,† in Carmarthenshire, where many other smaller ones,

* I understand that this term is applied by Cornish miners to water of great depth.

† *Ogofau*, plural of *Ogof*, a "cave," pronounced Ogóvy, the accent being always on the penultima. When preceded by y ("the") it becomes *y Gogófau*—according to the rules of euphony in Welsh mutations.

varying from 130 feet to 300 feet in length by 100 to 160 in breadth, occur at intervals in a space measuring 25,000 feet by about 450; and where other narrower workings extend through the hill, and plain below, for a distance of more than half a mile farther. The Romans succeeded the Britons at these mines; but their mode of working was different, and is readily distinguished. More scientific than their predecessors, they drove shafts directly through the rock into the quartz veins containing the ore, the flat roof and upright sides of which were hewn by the pick with the same precision as a road, or the entrance to a tomb; while in other places, where the quartz vein ran irregularly, they followed its various directions, and left the walls of the lode on either side as in the Cornish mines at Carn Brea, and other places, which I therefore consider to be of Roman, not of British, time.

About 460 feet from the north west end of the summit of Carn Brea is the "monstrous rock," mentioned by Borlase (p. 117), on the sloping ascent of the hill, upon which are some natural rock-basons (A V in my plan). Borlase thinks the great difficulty of climbing to the top of this "vast rock * * * will prevent us from reckoning it among Druid altars," but considers it "might serve for some of the *Gorseddau* or places of elevation, from whence they used to pronounce their decrees." The difficulty, however, of its ascent would be equally an objection to their pronouncing "decrees or oracles" from its summit; and if used for any mysterious purpose it was most probably analagous to that of the large blocks carved with concentric rings, outside the camps of Old Bewick and Rowtin Lynn in Northumberland; though neither on this, nor any other stone in South Britain, have any of these markings been discovered.*

I shall now proceed to describe the interior of the town and citadel of Carn Brea. The latter, which occupies the western part of the hill, stands on more elevated ground than the town, from which it is separated by a wall (U b.); and is now readily distinguished by the column erected there in 1836, to the memory of the late Lord De Dunstanville. Amidst the masses of rock in this part is one (marked V) which having been worn away by the action of the atmosphere so as to resemble

* See my account of the concentric rings in a paper on Rock-basons and British Remains, in the Journal of the Archæological Association of June, 1860. Vol. xvi.

the five fingers of a human hand (or rather the paw of a beast) was once believed to be the petrified hand of a giant; and at U is a remarkable block of granite, measuring about 16 feet east and west, and 19½ feet north and south, in which are several large rock-basons with upright sides, the largest about 2 feet 2 inches in depth, and varying from 3 feet to 7 feet 3 inches in diameter.

Rock-basons are common in granite, as in gritstone, and are mostly formed by natural agency, but some few which are of a well defined and regular shape, of great depth, with upright sides and a flat bottom, without any particles of decomposed stone within them, are evidently artificially made, and among them I am disposed to rank these large basons of Carn Brea. It is sometimes difficult to distinguish between natural and artificial basons; but when the above characteristics are present to assist us, and the spouts are so clearly defined (as is sometimes the case) that we might suppose them the work of some modern mason, it is easy to decide between them; and when, as here, numerous rocks of granite under exactly the same conditions as the present one, and subject to the same atmospheric agency, have not only no basons approaching to them in appearance, but merely present a few of insignificant size and depth, we may fairly suppose that the dissimilarity is attributable to the caprice of man, rather than to that of nature. That natural basons may have given the first idea of artificial ones, is very probable; and, I think, we may sometimes perceive the change that nature has also made, at a later time, in artificial basons, which have been enlarged and made of irregular shape by the decomposition of their sides. This has also taken place in the large basons of Carn Brea. But as I have treated the subject more *in extenso* in another place,* I need only observe that in the gritstone formations a similar difference is perceptible between the two; and that some basons occur in rocks which are not subject to the same decomposition as gritstone and granite; always, too, in places where British remains are met with.

The age of the town on Carn Brea cannot be exactly ascertained; but the discovery made there, in 1749, of coins

* In the same paper on Rock-basons and British Remains in the Journal of the Archæological Association of 1860. Vol. xvi.

of British Kings,* contemporary with the first Roman Emperors, leaves no doubt respecting the origin of the place; and the style of the masonry in the walls accords with that of the fortified camps of the same period. We have, therefore, some clue to its approximate date, and can without hesitation ascribe it to the British period previous to the final conquest of the country by the Romans.

Towards the centre of the eastern position of the place, which I have called "the town," in contradistinction to the citadel, are some hut-circles; eleven of which may be clearly traced by the walls of large stones of which they were built.

Similar huts are occasionally met with in other British towns; though not, as some suppose, "in every ascertained site," even when "undisturbed;" for it is evident that when built of turf, earth, or other perishable materials, no vestige of them could possibly remain to this day; and there are few in which the exact form of the walls has been so well preserved as those on Dartmoor, where their massive granite blocks, occasionally measuring 4 to 7, and even 8, feet in length, by 2 feet 9 inches in breadth, and 2 to 4 feet in height†, placed upright on their ends, or on their edges, retain their original position, and if undisturbed by man will retain it for ages to come. It is from these that we understand the real character of some of the abodes of our British ancestors; and even those at Carn Brea give a general notion of their character and dimensions. Like many on Dartmoor they are about 29 feet in diameter, or 22 to 24 feet internally; and are furnished as usual with one doorway; the walls varying from 2 to 3 feet in height, according to the state of their preservation, and the size of the stones, some of which are 2 feet and a half high, and 2 to 3 feet in length. One hut, which is in better condition than the rest, stands beneath a rocky eminence towards the east end of the town, near the wall M, and the gateway A; and though their sites are generally chosen with a view to shelter, warmth, and dryness, the family who occupied this

* See Borlase, pl. xxiii, p. 259.

† In one, near Teigncombe Tor, six successive blocks measure 4 feet 11 inches; 6 feet; 5 feet 10 inches; 5 feet 8 inches; 4 feet 11 inches; and 5 feet; with a height of from 2 feet 9 inches, to 3 feet, all placed on their edges, and of granite.

hut, with its door opening to the south-west, must occasionally have enjoyed an inconvenient amount of summer heat. We may hope that they lived much out of doors at that season.

But before I enter into any general description of these hut circles, I must offer a few remarks on the objections raised against their being of early date, and endeavour to place before the reader those evidences which may lead to some decision respecting their age. It has been asserted that they belonged to miners of late times, even of the reigns of Henry the Eighth, and Elizabeth. But, 1°, this is consistent neither with their position, the character of their walls, nor their general appearance; and it would not certainly be the object of those workmen to perch them on inconvenient high grounds, nor necessary to secure them from the attack of enemies by building them within fortified towns, like Carn Brea, Grimspound, and other strongly walled places. Nor would anyone for a moment imagine that Carn Brea, or Grimspound with its massive old walls which enclose within their area 25 of these hut-circles of similarly massive construction, was of the time of Henry the Eighth or Elizabeth.* It also frequently happens that they are in localities far from any mines, while more convenient spots could have been selected in their immediate vicinity; and I have met with some where a stream and precipitous banks intervene between them and the mines, when many very eligible sites could have been found on the same side of the river. If they often, or even generally, occur in Devonshire and Cornwall in the neighbourhood of mines, this is not extraordinary in two localities abounding with mineral wealth; but as they are not confined to those two counties, and the same kinds of hut-circles occur in parts of Northumberland, in the old red sand-stone and mountain-limestone district of Gower in South Wales, and in other spots where no mines exist, the notion of their being mere miners huts is at once disproved.

2°. The labor and loss of time, consequent upon the erection of hut-circles with enormous heavy stones, could not be afforded by miners at a sacrifice of more profitable occupations; no

* If the huts had been introduced there at a later time, when the defences were not required, they would have been built *against* the wall of circuit for the sake of greater strength, more shelter, and a saving of labor in their construction; and this has been done by some *later* occupants of these and other enclosures.

single man could transport and place *in situ* blocks of granite measuring from 4 to 7 feet in length; and the labor of many would have been required to build a single hut; and it is far more reasonable to suppose that miners would run up a temporary abode, than sacrifice so much combined labor in erecting one destined to endure for ages, on the remote chance of passing their whole lives at the same mine. And this applies with greater force, when we recollect that there are sometimes more than 20 or 30 huts in the same locality. Even if they built huts of this durable character, they would not have enclosed fields with equally massive walls; still less would they have extended similar walls for miles over the country, as I shall presently have occasion to state; nor would miners require the large enclosures seen about these hut circles, whether their object was to surround arable land, or to keep in cattle. These were not the requirements of miners.

3°. Regarding their continued occupation to the time of Henry the Eighth, we require some confirmation of this conjecture. They might be occupied now by anyone who would add a few stones to the upper part, and a temporary roof; but this would not give them a modern date; and we know that long before our Tudor times towns and villages already existed, the masonry of which had a totally different character, with hewn stones put together with mortar (which is not met with in any of these huts); and in the plans of houses the rectangular had long taken the place of the circular form. This, then, may be rejected as totally unworthy of further consideration, and at variance with experience.

With regard to their probable age we have evidence, from their masonry being similar to that of the fortified towns in which many have been found, that they are sometimes of the same periods; and the strength of those forts proclaims that they were of a time when fear of attack rendered such defences necessary. And when we meet with hut circles in Northumberland, and other distant counties, in similar strongholds, we can only conclude that the normal state of the whole country was one of insecurity. Defence being the object of those fortified camps, or towns, let us enquire what were the periods when they were most likely to have been erected. Was it before the Romans became *absolute masters* of Britain, or after their departure from it?

As the conditions of the Britons, at this latter period, was not such as to admit of their erecting the strong fortresses seen in different parts of the island; as the Romans would not have permitted their erection during their settled occupancy of Britain; and as Roman coins have been discovered in some of them, as at Carn Brea, Dolberry, Cadbury,* Worlebury,† and others, we have proofs of their being already in existence before the Roman period, or at least before the final subjugation of the island by the Cæsars. Nor are they mere places of refuge, such as a few mountaineers would raise; still less (as others have supposed) mere enclosures for sheep; and if some small camps, as on the Cheviots, and elsewhere, have been used for the latter purpose at a later time, as shown by the rude piles of stones which stop up the gateways, and gaps in their old walls, the style of the two works at once proclaims the difference of date; and walled camps, such as that of Dolberry (the inner area of which measures 1500 feet by 750, varying to 630 feet in breadth), and the still larger town of Carn Goch in South Wales, which is 1980 feet in length, with an average breadth of 550, were not constructed—with their strong stone walls and extensive outworks—by any people who inhabited Britain after the departure of the Romans. An additional argument against their having been erected after that period is the absence of mortar‡ between the stones; which, with the rectangular form of walled cities and houses, had already been introduced into the island; and the fact of Christianity having long been established there would require at least some evidences of that religion within their precincts.§

We are, therefore, led to the obvious conclusion that these strong forts were of British time; partly before, partly con-

* Principally of Antoninus and Faustina. *Cad-brê* is "battle-hill;" and *Dol-brê* may be "hill of wailing," *(dolor)* or "of the bow."

† "Worle" or "Whorle hill." This name seems to have led to that of the later *Weston*—or West town—which stands below it. *Worle* being *orllewin* or *gorllewin* "the west." *Gwo* is a prefix for *Go;* and *v* or *w* is a well known mutation for *Gw*. The termination *bury* is the usual *brê* "hill."

‡ I have seen piers at a gate of one in Somersetshire called Batt's Castle, near Dunster, built with mortar; but they are a later addition, and the place is called the "Roman Camp." It is in reality British, and was, perhaps, afterwards occupied by the Romans.

§ I have observed in two forts what may have been chapels, of rectangular form; but they are of later date than the walls, being built with mortar, and afford evidence of the old forts having been occasionally used as places of refuge at more recent periods.

temporaneously with, the conquest of Britain by the Romans; and as hut circles occur within them, of a style of masonry similar to that of their walls, we may infer that some of these at least are of the same period; though others may have been built long afterwards. The form of the round hut, it is true, may have continued after the departure of the Romans; but an occasional rectangular building would necessarily have been now and then introduced; and yet amidst more than a hundred and fifty hut circles that I have seen on Dartmoor alone, none have any approach to a rectangular plan, except two near Castor of uncertain date and apparently stables, and one in the scattered village near the avenues above Merivale Bridge, which is evidently introduced at a later time, as I shall presently have occasion to explain.

If again the smooth grass, which so often forms the present floor of these hut circles, is brought forward as the sign of a later date, I need only observe, to those who are not conversant with ancient remains, that this is one of the signs of human occupancy, and is met with within sacred circles, and similar ancient British enclosures.

Those hut circles which stand away from any fortified place, on the slope of an open hill—where they are often found facing to the southward, and frequently with a stream at a convenient distance below—appear to show that they were built at a time when the country enjoyed great security; which was precisely the condition of Britain when occupied by the powerful Romans after its entire conquest by them. Unlike the previous period, during which strong defences were required against the hostile incursions of warlike tribes, and the whole country was divided into numerous petty states, each at war with its neighbour, the Roman occupation enabled the people to live without fear of an enemy in arms; and all that was necessary was to surround their fields and other enclosures with strong walls, to prevent sheep and cattle from straying, to secure them from wolves (not yet destroyed in our island), to afford them shelter from the weather,* and to define the limits of their lands. But, as

* Shelter was evidently provided for in these early times with a sagacity which might shame some of our amateur farmers at the present day, who sweep away all hedges, as if vegetation and cattle required no further protection. They will discover their mistake when practical take the place of theoretical notions.

even in a still more settled period of our history, the plunder of cattle by robbers was not unknown, they took one precaution, which was to carry strong walls of great length across the country in different directions, extending over hill and dale, and sometimes in a straight line for miles; the object of which was, while the flocks and herds grazed at a distance by day under the care of a few shepherds, to prevent the country being suddenly driven by marauders. The impediments thus offered by these long walls would delay them sufficiently to enable the owners of the cattle to pursue and overtake them; and I have no doubt that this, and the delineation of property, were the two objects of those walls, which, now known under the name of "boundary lines," (and sometimes by the very inapplicable one of "trackways"), are so general throughout Dartmoor, in Cornwall, Wales, and other districts.

It must, however, be observed that many of these "boundary walls," as well as hut circles, are of much later date than the avenues and other monuments of Pagan times, since the former are occasionally found crossing an avenue, as at Castor; and the same method of building those walls and huts may have continued, as I before stated, long after the departure of the Romans, and the conversion of the Britons to Christianity.

I feel that I ought to apologise to the reader for occupying so much of his time in discussing the age and British origin of the fortified camps, and the hut-circles within them; but it is interesting to enquire whether they accord with the history and habits of our ancestors, and with the state of the country in early times.

In giving a description of the hut circles, those of Dartmoor deserve particular attention, being the most perfect which remain, and of a construction at once superior to, and more durable than any others. Many villages composed of them occur in different parts of that district; among the most remarkable of which are those near Merivale Bridge, about 2 miles north-west of Prince's Town, consisting of about 40 huts varying in size from 41 to 38 feet in diameter (or 30 and 28 feet within their walls) to 16 or 14. Their usual diameter internally is about 23 or 22 feet; and the smallest about 9 feet 3 inches. They are all circular, except one, already alluded to; which is rectangular, and measures about 28 feet by 19 feet

4 inches in breadth, or internally 22 feet by 13 feet 10. But though old, it is of later date than the circular huts about it; and since its back walls, as well as those of the rectangular enclosure appertaining to it, which was probably a garden or a small field, are built upon, and interfere with, the direction of older walls, we have convincing evidence of its being a subsequent introduction. The jambs of its doors are also built in horizontal courses, which generally indicates a later date than those of single upright stones; and in the masonry of the walls earth, or some substitute for mortar, appears to have been used, which is absent from those of the hut-circles.

Sometimes a hut stands within a large enclosure called "Pound," surrounded by massive walls; as near Merivale Bridge, at the "Round Pound" near Castor, at a village opposite Rippon Tor, and many other places. These "pounds" vary in size, and form.* They are sometimes circular; sometimes irregular, like the four near Merivale Bridge, one of which is remarkable for an enormous block, or mass of rock, on one side, now 14 feet by 13, and once longer, the height and length of which was taken advantage of in the formation of that part of the wall.

The largest huts on Dartmoor have a double, the smallest a single, wall; which is generally built of blocks of great size, varying from about 6 to 5, and 2 feet in length,† always of granite, and set upon their edges, or occasionally upright on their ends; those forming the doorposts, or jambs, being nearly always placed in this manner, and measuring about 3 feet 4, to 4 feet 2, in height above the *present* surface of the ground, 2 to 3 feet in breadth, and 1½ foot, to 2 feet in thickness. The lintel is one large stone about 5 feet long; but has invariably been thrown down, and lies in or near the entrance, which is from 2 feet 3, to 4 feet 6 in breadth. In the largest huts the doorway was formed of the two jambs, and of large slabs set on their edges at right angles with the door, forming the two sides of the entrance passage, the whole of which was covered by other lintel stones.

*"Round Pound" has a diameter of about 105 feet; one near Merivale Bridge 190 by 100 feet; another 150 by 95 feet. Grimspound is different, it is a walled village, and has a diameter of 502 by 447 feet.

†Sometimes much longer, as stated above.

The walls vary in thickness. In the large huts they are often 7 feet thick, in others 5. The doorways, as I have already shown, generally open to the southward, from about south south-east to south south-west, depending upon the general disposition of the land, the neighbourhood of a rocky eminence, or other accidental circumstance.* In some few instances the walls are from 10 feet 9, to 11 feet 3, thick, and are treble; that is, composed of three rows of slabs one behind the other, having intervals between them, which are filled up with other large stones; and Mr. Ormerod mentioned one hut to me which has a raised bench all round the inside of the wall. In the smaller ones the walls are only about 2 feet thick; and a single stone occupies the whole width.

In those I examined I was not successful in finding anything, nor any indication of a floor; but charcoal, nutshells, and a few other substances have been discovered in other huts, with the marks of fire on the stones within them; when of that particular kind characterized by a small pit in the centre.† These pits, however, appear (like some at Worle Hill) to have been intended for storing small quantities of grain; and the marks of fire within them may be attributed to the subsequent burning of the hut and its contents, rather than to the use of the fire by its inmates, who would not live in a pit resembling an inverted sugar-loaf, and would not render a fire useless to them by making it in a deep hole out of their reach. The hut, doubtless, stood over the pit; and the small "rim" round the pit may have served for supporting the reeds, or stakes, of which the walls were made (as described by Diodorus) in those parts of the country where stone could not be easily obtained; and this may not indicate great age, but rather the want of better materials for their construction.

The arrangement of slabs, placed upright, on their edges, or on their ends, was consistent with the circular form of building, and I am disposed to consider this style of construction was

* I have found the doors opening to the south, south by east, south-south-east by south, south-south-east a quarter east, east-south-east, east-south-east half east, east by south; and south-south-west, south-west, south-west a quarter west, south-west by west, west-south-west, west by south, &c.; and occasionally north-west, and north-north-west a quarter north (by compass). The most *usual* direction of those at Merivale Bridge, and in Grimspound, is a little to the west of south.

† See Journal of the British Archæological Association," congress 1846, p. 153.

intimately connected with it. And though rectangular blocks placed horizontally would never have led to the circular arrangement, they often formed part of the circular wall in after times, when added to walls of orthostatic structure. For not only did the old mode of upright construction continue long after the horizontal method was adopted, but we find all three styles combined in the same walls; and the same combination of upright stones and horizontal work occurs in far more decidedly orthostatic remains; as at *Hagar Keem*,* in Malta, and at the *Torre de Giganti* in Gozo. Again, the circular arrangement arises from the earliest and most natural idea of *shelter*; it is the quickest made, takes the smallest amount of materials, and is most easily roofed; and it is the one adopted by man in his most primitive state.

In one hut-circle near Castor, is a large slab, which has the appearance of a fireplace, being in a recess of the wall at that part; but if really so, and originally placed there for that purpose, it is a solitary instance; and it was doubtless the usual custom to light the fire in the centre of the hut, the smoke escaping as it best could through the doorway. The roof was evidently made of some materials, which on falling in have entirely perished, as no mound, or other traces of its existence are to be found in the centre of the hut; which would have remained if it had consisted of stones, however small, or even of turf; and I, therefore, conclude that it was composed of straw, reeds, heather, or some equally perishable materials, such as are still used in Wales and Scotland for a similar purpose. If poles and branches of trees supported the thatch, the roof thus carried to a point would turn off the rain, and give ample room in the centre of the hut; and it is generally supposed that the character of the British house is retained in the Welsh pig-stye, with its circular stone wall surmounted by a pointed roof of thatch or stone; though this last, when of stone, is more probably derived from the old beehive hut.

Those huts, which had a roof of small stones, mixed, and covered, with earth, and turf, present a very different appearance from the hut circles, whose walls were made of slabs of granite, with a thatched roof; and the former in their ruined state have a mound in the centre which, with the small stones

* The "upright stones."

within it, proclaim the character of their domed roof. Instances of them may be seen on the hillside above Withycombe, in Somersetshire, a little to the east of Dunster; and the style of their construction was doubtless owing to the nature of the materials in that locality, where the large masses of granite abounding on Dartmoor could not be obtained; and mud, with small stones, was used both for the walling and the dome. In some parts of Britain, indeed, the wooden hut was probably substituted for that of stone; and Diodorus therefore pronounces British houses to be of the poorest kind, built for the most part of wood, or reeds.*

Some of the domed huts are about 24 feet in diameter or 20 internally; and the stones of the walls vary from about 2 feet to 10 inches in length. They are found in various parts of Britain. But there is another kind of house in Cornwall of a still more remarkable character, which I have distinguished by the name of "bee-hive hut," answering to the *cloghaun* or "stone hut" of Ireland.† It is unlike the dome-roofed hut and the hut-circle, but is precisely similar to some in Ireland, given by Mr. Petrie in his valuable work on the Ecclesiastical Architecture and Round Towers of Ireland; and, indeed, that called by him the "House of St. Finan Cam" (p. 131), is so like one on the east side of Brown Willy that it might almost serve for a sketch of it. These bee-hive huts are the more singular as I believe them to be unknown in the South of England,‡ except at Brown Willy and at Old Tresellan, opposite Kilmarth; the latter amidst the houses of a later village, the road to which passes partly over their roofs; the former no

* The German houses, on the Antonine Column, are evidently of wood.

† Not "bell-hut," which might be supposed from its form, and from the resemblance of its name to *clock*, a "bell." *Clog*, *clogan*, or *cloghaun*, signifies a "large stone" in Welsh and Irish.

‡ Mr. Rowe mentions a bee-hive hut on Dartmoor;—("Perambulation of Dartmoor," p. 52, edit. 1856)—and other roofs formed of overlapping stones have been found at Chyoster, or Chysoster, as well as in a cave near Penzance, mentioned by Mr. R. Edwards in the Journal of this Institution (Appendix vi. p. 30, 1857). The roofs of the *weems*, and Picts' houses, in Scotland, are also formed of overlapping stones; and a similar mode of roofing was common in Greece, Italy, Sardinia, Egypt, Mexico, and other countries, at a very remote period. But this method of roofing differed from that of the beehive huts.

the two sides, east and west of the hill.* The eastern hut at Brown Willy measures about 11 feet 3 by 10 feet 9 in diameter, including the walls, and 7 feet 3 by 5 feet 11 internally, being not quite regular in its form. Its height is now about 4 feet, varying to about 4 feet 4 or 4 feet 6 above the ground; but as this has been much raised, both internally and externally, we may allow a little increase of height to the centre of the roof, which is formed of granite slabs, the largest measuring about 5 feet 9 by 2 feet 8, and from 3 to 4 inches in thickness. Another slab is 5 feet long by 1 foot 10 in breadth, and the lintel, which still remains over the doorway, measures 3 feet 1 inch in length. The doorway is 2 feet to 2 feet 3 broad, widening slightly inwards, and about 2 feet 2 (originally perhaps 3 feet) high; each of the jambs consisting of four stones in horizontal courses; and, as it is sheltered by the neighbouring hill from the N.W., it opens in that unusual direction. Part of the roof has fallen in, but the greater portion remains in its original position. It was formed by overlapping stones, the uppermost of which capped its centre, and the whole was covered with turf, vestiges of which may still be seen upon the unmoved slabs of its N. and N.E. side. A boundary wall abuts against it on the E. and W., about its centre, which, descending from the hill above, continues its course to the plain beyond, and has the appearance of being of older date than the hut.

Near the summit of Brown Willy, on this, the east, side, are vestiges of other rude huts, partly formed by the overhanging rocks and partly of rough masonry; and on the west side, below the brow of the hill, are two of the same kind of bee-hive huts, roofed with overlapping stones. One of them measures 7 feet 11 by 6 feet, within its irregular walls, which are composed of large blocks, and partly of the natural rock; and its doorway, which varies from 1 foot 1 to 1 foot 4 in breadth, has the lintel resting on jambs composed on one side of four tiers of stones in horizontal courses, and on the other of one block resting on the rock. This is a peculiarity which distinguishes them from the hut-circles, which always have

* Brown Willy is evidently *Bron Welli; Bron* signifying a "front or "projecting part" (the Latin *frons*), and *Welli* a "look out place"; and is so called from being a prominent hill.

each jamb of a single upright stone. The height of this hut, on the west side of Brown Willy, is now 4 feet 6 inside, having been originally higher; and some of the stones of the roof are 4 feet 7 and 3 feet 10 long, by 2 feet, the average being about 2 feet 2 by 2 feet in breadth. The greater part of the roof has fallen in; but sufficient remains to show the style of its construction, its solidity, and original appearance. Advantage was taken of the rock, in selecting its position; and if its form thereby became more irregular, its construction was more solid; and the other hut, close to it, entirely built of stone, and perfectly round, is very inferior in size, having only a diameter—each way—of 8 feet *externally*, and being very low. It was once united to its larger neighbour by a wall. Their doors are nearly facing each other; the larger one opening towards the S.E., the other to the N.W., overlooking the valley between Brown Willy and Rowtor.

The granites here present a remarkable appearance, being in layers like schistous rocks; and the facility with which they break up into long flat slabs pointed them out as fit materials for roofs formed of overlapping blocks. Poised too on each other, many of them rock as you walk over them, though they do not aspire to the designation of "rocking stones."

Certain peculiarities may be noticed in some of the huts in various parts of the country, but none differ so entirely in their form and construction as these with roofs of overlapping stones;* which are the more remarkable, as I before observed, from being hitherto considered peculiar to Ireland. But from the horizontal construction of the jambs and walls, and the state of their preservation, I am disposed to think them of later date than the hut-circles, and (like those in Ireland) of a Christian time.† I may also state that the usual hut-circles are found at no great distance from Brown Willy, near the logan-stone of Liscarnik; showing that the two styles of building belonged to the same locality; and probably therefore at different periods.

* I have much pleasure in acknowledging my obligations to the Rev. R. H. Tripp, of Altarnun, for his kindness in pointing out these curious huts and other interesting remains in this part of Cornwall; and to the Rev. R. B. Kinsman, of Tintagel, for so kindly showing me the objects most worthy of notice in his neighbourhood.

† Mr. Petrie gives those in Ireland the date of the "sixth" and "seventh century," but I consider these in Cornwall to be later.

Within the strongly fortified works of Worle Hill (beforementioned) are other hut-circles, built of small sized stones; the limestone rocks there not furnishing the same large blocks as the granite districts; but their roofs were evidently of the same character as those of the hut-circles on Dartmoor, and the mode of covering them with straw, and wattled twigs is inferred from the absence of any mound, or remains of durable materials, within their circuit. They vary in size. Many are about 21 feet in diameter, some 16, others only 11 feet; but the most remarkable feature in them is a circular, a square or an irregular pit in the centre of each, hewn in the limestone rock; which appears to have served as a granary beneath the floor of the hut. Some of these pits measure 5 feet, by 4 feet 6; others 6 feet by 5, and from 3 to 5 feet deep; and one circular pit is composed of an upper and lower part, with a ledge apparently intended for supporting the planks which covered the lower, and separated it from the upper compartment, both which were cased with stone. These I believe to have formed two distinct store rooms, or granaries, which Diodorus tells us the Britons were in the habit of making underground for preserving their corn (*καταγειους οικησεις*), and from which they took daily what they required. The upper one measures 7 feet 4, east and west, by 7 feet north and south, and 3 feet in depth; and the bottom of it appears to have been flat. That they were intended for store rooms is rendered probable by the remains of corn found in some of them; in one instance with a wooden separation between the wheat and barley, as stated by Mr. Warre.* Fragments of pottery, sedge matting, charcoal, and pieces of stick—evidently of a wattled roof—were also found in these pits; as well as iron rings, supposed to be money; and in one was "the skull of a pig, which was evidently an article of food from its having been cut off before it was deposited there." It was in these that some of the inhabitants took refuge when the place was captured; and they tell an interesting tale of their alarm, and of the remorseless fury of the conquerors. In one a skeleton was found by Mr. Warre, wounded by three cuts; in another pit, "faced with dry masonry were three skeletons, the skulls and other bones frightfully gashed," beneath which was wheat

* See an interesting paper, by the Rev. F. Warre, in the Somerset Archæological Society's Journal, of 1851.

mixed with barley; and in another "a skeleton and an iron spike 4 inches long, "with which the individual was probably killed," and "under him . . . . . a large quantity of wheat and barley." And as the coins of Lucilla, as well as of Constans, and of other Emperors, found there, prove the place to have been already in existence at that period, there is no doubt of its having been fortified and inhabited before the conquest of the country by the Romans.

I may also observe that one of the skulls from Worle Hill, now in the Taunton Museum, has the same low forehead as those lately found at Wroxeter; and if not misshapen like them, this fact is of little importance, for whether owing to subsequent pressure of the earth, or to a natural conformation, it has no bearing on the question of a peculiarity of race, which may be more safely determined by their general form and characteristics.

In some rare instances a tomb has been discovered within a hut-circle, as in one below Hound-Tor; in another about quarter of a mile to the north-north-west of Rippon-Tor; and in one or two others on Dartmoor; but as I have already extended this paper beyond all reasonable limits, I will not enter into the extensive question of the sepulchres of the Britons; and shall only offer a few remarks on the opinion entertained by some archæologists of eminence, who maintain that sacred circles, as well as other monuments not of a military character, were sepulchral.

If by this we are to understand that bodies were buried within, or beneath, them, I fully concur in that opinion; and I have met with ancient British interments in the walls of a fortified camp. The dead are also buried in our Christian churches, though they are not sepulchral edifices; and it is out of all reason to suppose that a people who erected such colossal monuments as Stonehenge, Abury, Stanton-Drew, and others, in memory of the dead should have left no sacred edifices of equal massiveness and durability. The Britons had evidently the greatest respect for the dead, and the burial of their chiefs in the

* Tumuli were a general form of monument, and are found in the most distant countries. In the valley of the Nile, the circular *turabeel*, about 30 or 35 feet high, in Ethiopia, were of earth and stones, and the pyramids in that country and in Egypt, were square one tumuli.

very walls of a town was evidently with a view to honor them, and to render the works more sacred in the estimation of their defenders. The *cromlech* was a tomb; the *cist*, the stone *carn*, and the earthen *tumulus** were tombs; the *maen-hîr*, or "long stone," had probably a monumental object; and the sacred circles, particularly in Scotland, have been found to contain traces of sepulture within their area. Sometimes, too, as in Jersey, covered cells occur between the monoliths which from the circle. The cromlech is also said to have been met with, in some few instances, within a sacred circle, as well as the *cist*; though all the inegalithic structures roofed with large blocks, which have been styled cromlechs, do not properly come under that denomination.

The sepulchral chamber covered in with large slabs, which is nearly 40 feet long, called the Cromlech du Tus, in Guernsey, is not analogous to our cromlechs. Its enclosure of upright stones also differs from a sacred circle, and resembles that placed round some *tumuli* and *carns*, where instead of the usual heap of small stones, a row of large blocks placed upright, either close together or at intervals, surrounds the sepulchral mound. (See Journal of the Archæological Association, vol. I, p. 26, and vol. IV. p. 330.) Mr. Lukis very properly distinguishes *cists* and other tombs, from cromlechs (vol. I. p. 305); and the tomb at *Gavr Innis*, in the Morhiban, with its long passage roofed with nine stones is not a cromlech (p. 309, and vol. III. p. 271).

Another instance of the union of the tomb with other monuments is met with at Arbe-Low, in Derbyshire; where the lofty *agger* which surrounds the sacred circles has a sepulchral tumulus attached to it; and I hope Mr. Wright will excuse my differing from him, when he states† that it is "quite *certain* that the *majority* of such circles were originally made to support or enclose sepulchral mounds." I may also observe that there is no reason to suppose from its name "*low*," that Arbe-Low had a different object from a temple, or that its high mounds and two *tumuli* would not be sufficient to include it under the denomination of the Saxon *Low*, or the English "*mound*."

* See note on preceding page.

† "The Celt, the Roman, and the Saxon."—p. 58.

And how can we imagine that the central mound, supposed to have covered the cromlech within its area, was removed, while the external mounds and tumuli were left? Or that any persons would take the former in preference to the outer more accessible and abundant supply? Nor is there any proof, or probability of the cromlech, or as the French call it—*Dolmen*, having been originally covered with earth.* It would be difficult indeed to account for the *removal* of the high mounds from our cromlechs, (and still more from our large sacred circles)† when the earth still *remains* over the small tombs called *Cist-Vaens*,‡ and on the lowest tumuli.

It is possible, in cases where the cromlech has been buried, that this was done in Christian times to check the superstitious feelings of the people towards the monuments of their Pagan ancestors; for after various endeavors to prevent this, the Council of Nantes "in the 5th century * * * ordered such stones to be buried;" and Archdeacon Williams with apparent reason supposes that cromlechs were included in this order. Don Raphael Mitiana also speaks of *dolmens* covered with earth, and says (p. 11.) that the council of Arles, in A.D. 452, authorized the destruction of druidical monuments, as did the council of Tours in 567, and others; and "an ordinance of Canute, in the 11th century, threatened great punishments to those who, in England, practised superstitious ceremonies on the sacred stones."

I may also observe that the discovery of "Roman interments," either in sacred circles, or under cromlechs, in Britain, will never lead us to the conclusion that these two kinds of monuments are Roman, until similar ones have been found of

* Some are found in Scotland so buried, but apparently not of great size, and resembling rather subterranean chambers roofed by a slab, than cromlechs. —*Vide* Wilson's Prehistoric Annals of Scotland, p. 67.

† Witness that of Abury, about 1100 feet in diameter; the largest of the three at Stanton Drew, about 350 feet; that of Arbelow, internally, 136 feet; that on Gidleigh Common, 87 feet; the two of the Greywethers, each 105 feet; and others. The carn, or the tumulus, surrounded by upright stones, is a different monument.

‡ The Cist-Vaen, or "stone chest," is different from the cromlech, and it is no error of our Celtic antiquaries to distinguish them. They are both sepulchral, as are a coffin and a mausoleum; and the small low *cist*, or "chest," with its flat lid resting on a hollowed stone, or on several upright slabs, is equally distinct from a cromlech. It is true they are both tombs, but we require names to distinguish them; and classification and distinct names are very necessary.

Roman time in Italy and other countries; nor will it prove that they are of late date; we should rather infer that the circles and cromlechs were much older, and that the memory of their builders, and of the religion, had then ceased to be regarded. This is the precise conclusion we arrive at on finding Greek and Roman bodies in Egyptian sarcophagi, or tombs;* and we are much indebted to those "Roman interments" in circles and cromlechs, since they afford unquestionable testimony of the latter being anterior to the Roman period.

The fact of stone avenues leading to *cists*, to barrows,† or to barrows surrounded by stones, as well as to sacred circles, has also been considered by some to denote a similarity of purpose in the circle and the *cist*; and it is true that two below Black Tor, and near Castor, terminate in cists, while those at Abury and Stanton Drew lead to sacred circles. But honor to the dead did not exclude honor to religion, and future antiquaries will be in error if they pronounce our churches to have had a sepulchral, not a religious, purpose. For though our tombs in Westminster Abbey convey no very exalted notion of our taste, are out of place in a church, and give the impression of a store house of monuments, they will not disprove its use for purposes of devotion. But to suppose that the Britons had no sacred edifices or temples (or that these were of a less durable nature than their tombs), and that they paid less attention to religion than to their dead, is to consider them totally different from the rest of mankind. And to make religion, which gives sanctity to the tomb, of so little importance in the eyes of a race known to have been remarkable for "religious observances,"‡ and subject to an ambitious hierarchy, is to ignore the universal object of an idolatrous priesthood, and the means by which it obtains an ascendancy over a superstitious people.

GARDNER WILKINSON.

33, York-street, Portman-square.

* I hope no future antiquary may be "startled" at finding an English "inter ment" in an Egyptian sarcophagus.

† The barrow of *earth* surrounded by upright stones may be called a *circle-barrow*; and the *carn* of *stones* so enclosed a *circle-carn*. Some have concentric circles of upright stones within them.

‡ Cæsar says this of the Gauls, and shows that they looked on Britain as the fountain head of their religion. *A fortiori* therefore may it be said of the Britons.

## APPENDIX II.

## NOTES ON THE ORNITHOLOGY OF CORNWALL.

By E. H. RODD, Esq.,

*Of Penzance.*

READ AT THE SPRING MEETING.

Since the spring of last year we have not had many occurrences of rare British birds in the West of Cornwall. I believe I mentioned in my short paper last spring, that I had then recently obtained a very perfect specimen of the Male Golden Oriole from the parish of St. Buryan; since which the only decidedly valuable British bird that has come under my notice is the Alpine Swift, which was shot, I believe, in the parish of Mylor in the latter part of last summer. The late Mr. Jackson, of Looe, I think, once obtained a specimen in his neighbourhood and preserved it; if so, you probably have a Cornish killed specimen of this rare bird in your Museum, as the principal part of his collection was bequeathed by Mr. Jackson to the Institution of Cornwall. The bird killed last year has all the characteristics of an adult bird. There is no possible difficulty in recognising the bird on the wing, for its size is not only superior to our common species; but there is also a considerable portion of white on the breast and belly, which in the common swift are sooty brown. The wings are of a remarkable length, and more so in proportion than those of the common swift; the length from the carpal joint to the end of the longest quill feather is, at least, 8 inches. It is a species well known in the neighbourhood of Naples, and the southern countries of Europe to the Archipelago; the bird, soon after its appearance about the towns of Italy, retires to the mountainous

district of the Alps, where amongst the crags and precipices it rears its young. When Mr. Yarrell first published his work on British Birds, there were then six recorded examples of the occurrence of this curious bird.

Having only just emerged from a seven months' winter (frost having injured our potatoe crop as late as a fortnight since), I fully expected to have been able to report the occurrence of some of our rarer anatidæ; but with the exception of a few Shovellers, Golden Eyes, and Tufted Ducks, we have nothing to boast of except a multitude of the commoner wild fowl during the short but extraordinary severe frost in the early part of the past winter.

I have been long looking out in the spring and summer months, in this neighbourhood, for the largest species of our Willow Wrens, which may be found in the woods in the eastern counties, and which I have only been able to trace westward as far as the woods at Trebartha.

This species, however, which is known as the Wood Wren, or Wood Warbler *(Sylvia Sibilatrix)*, I discovered this morning close by Penzance in an orchard, uttering its sibilous jarring note varied at intervals with a low whining chirp repeated three or four times, very peculiar and quite unlike its characteristic song. I have no doubt that the bird may be found in considerable numbers in the more extensive woods of your neighbourhood.

EDWARD HEARLE RODD.

Penzance, May 8th, 1860.

## APPENDIX III.

## ON THINNING PLANTATIONS.

By J. S. ENYS, Esq.

The question is not devoid of interest whether a larger amount of saleable timber can be obtained on a given area of land from trees disposed in forest groups in imitation of woodland scenery, or from an equal number of trees spaced over its surface at equal distances from each other.

It will be my endeavour to point out the reasons for my belief:—

1st.—That timber of the greatest value can only be obtained by means of the interference of trees with the growth of each other.

2ndly.—That an unequal distribution of sunlight will afford the largest average quantity of light to trees in groups,

3rdly.—That their growth will be better promoted by the circulation of air occasioned by the unequal temperature of the thick masses and open spaces, than by the even temperature due to a regular disposition over the ground; and, lastly, to give the proportional members of interior and exterior trees in groups of regular forms, in the mode recommended by nurserymen for the regular planting and thinning of plantations. The object of these calculations is to aid the mechanical arrangements of irregular groups, such as would be advocated by landscape gardeners—as being found in natural forest scenery—and supposed to be due to the growth of trees in thickets of ~~fern~~ furze or holly by which the growth of saplings during infancy has been protected from injury.

The general position assumed will be that two-thirds of the land should be occupied by trees, and that one-third should be required for the glades and openings of woodland scenery.

Park ground may be considered as formed of two-thirds pasture and one-third wood, in which the highest degree of beauty and value of timber are often found in combination.

In such cases the differences between the interior and exterior trees are usually very distinctly marked, and it is on these distinct characters that the plans here advocated rest.

In plantations regularly thinned, the forms of the trees vary between two limits—the production of long straight stems—with round heads, and of short stems with large bushy heads.

An intermediate system of management has more or less a tendency to produce an imitation of single trees each in its allotted space; but the attempt is marked by a failure to obtain the health, luxuriance, and colour of the leaves of the highest type of beauty, of which an individual tree is capable of assuming in its natural growth.

This statement leads to the inquiry into the nature and character of timber required for the purposes of sale.

It appears to consist in the summer and autumn deposit of an annual ring, of cell growth—on the principal stems—whose increase of diameter is produced by descent of the leaf sap.

The stems support branches, which, in their turn, carry the spray and leaves whose elongation growth is developed in spring and summer by the action of the ascending root sap.

The increase of the branches in no respect differs from that of the main stock; but, as timber is produced on the stems, and faggot wood on the branches, it is desirable that the latter should be limited by conditions favourable to the production only of a sufficient number to act as conduct pipes for the intercirculation of roots and leaf sap, and the support of a sufficient number of healthy leaves. The amount of work performed by the leaves, and the place of the deposition of their products, are consequently the important elements in the formation of timber whose existence in a tree is limited to the duration of its framework in a sound, or semi-living state, a period which varies with the nature of the soil, and the degree of its exposure.

The first depends on the sunlight and circulation of air, as leaves have no internal power of changing the air in contact, but are dependent on external forces; the second, or relative

proportions of stems and branches, depend on the distance of the trees from each other; and the extent of the mutual interferences of their growth.

The comparative failures of attempts to cover the whole surface with single trees, probably arises from the limited period of the action of the mid-day sun, and the long continuance of the twilight shadows due to the low angle of the morning and evening sun.

Even ferns require an hour's sunlight for the healthy development of their seed; and they only grow well in the glades and openings amongst trees.

In forest groups the interior trees are similar to those in thick plantations, and their timber is suitable for planking. The exterior trees are in the condition of single trees, exposed on one side only to light; the necessary contest for mastery ends in the production of curved stems, and irregular side branches.

The comparative value of timber of this form is, however, most distinctly marked in oak woods in the supply of knees and breast hooks, floor and futtocks, required for the frames in shipbuilding; but the same principles of growth, in reference to the reflection of sunlight and air on leaf action, are more or less applicable to other trees with modifications as to the size of the grouped masses.

The limit of their size seems to be the distance to which the morning and evening sun can penetrate among the stems.

The size of the opening depends in a great degree on its direction; the narrow glade pointing east and west will admit the morning and evening sun for a longer period; while the broader openings are more favourable to the full effect of the influence of the mid-day sun; these conditions consequently indicate that variety should be regarded as much for the commercial growth of timber, as for the beauty of the woodland scenery.

It is desirable that the limit of measurements of the size of the openings should be made to alter with the variations of the soil and exposure, and this can be readily effected by the adoption, in each case, of the probable height of the growth of the trees; these limits will be about 60 feet for inferior, and 90 feet for good land, in order to obtain proportional openings for an equal admission of sun and air.

The exposure, however, is another interference condition, which should be duly regarded, more especially in the earlier period of the growth of trees, and the effects obviated by curved lines of opening.

The character of the change that is produced by the formation of an opening in a thick plantation, is best indicated by the immediate growth of brambles in the ground exposed to the sun; and of grass among the stems of the trees in the groups which have not been thinned.

The close damp feeling occasioned by the continued shade disappears, and as the air is warmed by the sun it rises in the openings, and is replaced for that under the stems, so that the extent of the circulation is proportional, not only to the heat of the day, but to the increased time of its action from the effects of the morning and evening sun.

It may be fairly urged that these openings which admit heat, will equally admit cold; and that the growth of spray and leaves will be most favored by an equal temperature. The force of the statement will be readily admitted in reference to the elongation growth in spring, but it is not so applicable to the formation of timber in autumn, and it is balanced by the useful effect of cold in autumn, in ripening and hardening the spray, and providing for the formation of healthy buds ready for the successive growth of the next spring on a sound foundation.

These openings are of equal value to the game preserver, as the admirer of landscape scenery—though woodcocks and pheasants probably more appreciate the warmth and dryness of the open spaces, than the artistic beauty of glades of sunshine among the stems, and the reflected lights from the upper branches.

A few statements of the proportional number of trees have been exhibited by dots, in irregular forms, in order to assist the mechanical arrangements for effecting the object proposed; but a very little practice in cutting glades, and crossing-cutting to form groups, will prevent the commission of serious errors, if care is taken to underdo the work, in the first instance, until the requisite knowledge of the size of the openings suitable to the area of the plantations, its site and exposure is acquired.

No error, I believe, is ever committed in drawing up forest trees in height, provided sufficient care is taken in a cautious admittance of sun and air in subsequent openings.

Injury is not occasioned so much by carelessness, or caution, in the first instance, as by rashness in overthinning of trees that have been drawn up, and are in a tender state from deficiency of sunlight and air. In cases of this kind, I believe, the system of forest groups not only affords the safest remedy, but is likely to produce in its results trees of form superior to that which can be obtained by regular thinning.

The general conclusion may be stated that the commercial value of timber will be proportional to the effect of the woodland scenery. The previous definition of Timber excludes that variety of beauty in trees which coexist with their decay.

## APPENDIX IV.

## ON THE RECENT EARTHQUAKE SHOCKS IN CORNWALL AND YORKSHIRE, AND WHIRLWIND NEAR PENZANCE.

By RICHARD EDMONDS, Esq.

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In May last, I communicated an account of a slight earthquake shock at Tolvadden Mine, near Marazion, about the time of the great earthquake throughout Spain and Portugal, which shook every house in Lisbon on the 11th of November, 1858. Since which, this county has been visited by extraordinary agitations of the sea—on the 25th and 26th of June, and the 4th of October, 1859—the former occurring during the maximum temperature of that year—the latter being the most remarkable on record in this country on account of its extending inland up creeks and harbours as far as Truro, Wadebridge, Bideford, and Bridgewater. Of these I have given a very full account to the Royal Geological Society of Cornwall. Two smart earthquake shocks have since occurred in this county, on the 21st of October, and the 13th of January, the latter of which was severer than any hitherto recorded here. One lunation before (on the 14th of December,) some damage was done near Penzance by a whirlwind, followed by an earthquake-shock in Yorkshire on the succeeding day.

On Friday, the 21st of October, 1859, at about 6.45 p.m. (local time) a smart earthquake-shock was felt in most parts of Cornwall, accompanied with the usual sound on such occasions. At Truro the vibration caused the glasses and earthenware in some houses to strike together. On the north coast the vibration was more considerable. At Redruth it continued for

about nine seconds, coming apparently from south south-west, and travelling north north-east. Near the beacon of St. Agnes the houses were shaken, although the miners underground in that vicinity did not experience anything unusual. In the neighbourhood of St. Austell, however, persons on the surface thought their houses were falling down, and miners underground imagined the shafts, or excavations, were falling in, and expected every moment to be buried alive. These particulars I gathered from the *West Briton* of the following week. In addition to which, I have ascertained that the shock was felt about the same time also in Penzance, and in Rosevale three miles north-east of Penzance. At Falmouth, where it was very smart, it was attended, as well as at St. Agnes, with fierce lightning of an unusual character, but without thunder.

The weather throughout Britain underwent this day a very great change; piercingly cold winds from the north and north-west set in, and in the afternoon and evening there were severe hailstorms in Cornwall. At Perran-porth, on the north coast, where the cold was extreme, the hailstones in one of these storms were of extraordinary size. Mr. Lowe, from Highfield House Observatory, near Nottingham, records that the 21st was a fine and cloudless day—intense frost—barometer very low*, faint red *Aurora Borealis* at 6.30 p.m., lightning at 7 p.m., and the greatest cold during the following night was 23.5—intense frost killing all half-hardy plants. On the 22nd there was a violent hailstorm in the afternoon, and the greatest cold the following night was 22.4, with the severest frost ever recorded in October at the Observatory. This temperature was *lower* than had been ever observed in October, which is the more remarkable as the temperature of the 4th of October last, when the sea was so extraordinarily agitated in the west of England, was *greater* than had been known in the month of October. In the north of Scotland, also, the weather had been comparatively fine until the 21st (the day of the shock); but that morning snow began to fall very heavily, and by night it lay in many places six or eight inches deep.

* The barometer at the Kew Observatory, this day, was at a minimum of 29.329 lower than for 101 days before, and five days after.

Remarkable as was the 21st of October, 1859, for the suddenness with which cold weather set in, it was not more so than the 14th of December following; at 3 p.m. of which latter day a dreadful whirlwind, in the form of an inverted cone, white as snow, was seen near Penzance travelling in a nearly straight line from north by east to south by west, at the rate of about 10 miles an hour, accompanied with a tremendous roar from which the cattle in the field fled with terror. The sound was compared to that of a dozen railway trains passing at one time over as many wooden viaducts, and was heard in several places 60 or 80 seconds before the whirlwind arrived. Its whiteness proceeded from the great quantities of snow it had caught up, much of which it afterwards formed into huge snowballs, and at intervals cast them to the ground. Its track from Trevayler to Zimmerman's cot, a distance of more than two miles, was in many places strewn with orchard trees, and the tallest elms which it had rooted up. The rookery at Trevayler, the seat of the Rev. William Veale, was the first place that suffered. Through the midst of it descends, in a straight line towards the north-east, an avenue or road, bordered on either side with a row of tall elms. Down this road Mr. Veale's coachman had gone that afternoon with his fowling piece and dogs, but had scarcely reached the grove of ash trees at the foot of it before he heard a most fearful roar, and soon afterwards, during a furious hail storm, the trees of the grove were swayed up and down, and to and fro in a most terrific manner, and the dogs gathered round him for protection. When the whirlwind had disengaged itself from the trees he saw it rushing along the south by west, rotating on its axis with fearful rapidity, and carrying up the snow from the ground to a height of between one and two hundred feet. On questioning him, I found that the rotation was north, east, south and west, like that of the hands of a watch, and contrary to that of revolving storms in the northern hemisphere. He then returned up the avenue and beheld three of the elms on its north-western side torn up by the roots and lying across the road with their heads towards the south, and an elm on its south-eastern side also torn up and prostrated in the same direction. When visiting the spot a few days since, I was struck with the remarkable manner in which the whirlwind

had acted on the avenue. On its north-west side, upon which the whirlwind must have first fallen in an oblique direction, I observed as I walked down through it—first, a tall elm half rooted up and almost ready to fall across the road; five or six feet further down were the remains of another elm, which had been quite rooted up and thrown across the road; then came four tall elms not at all injured, occupying 36 feet on the same side; below these were the remains of two other elms which had been rooted up and thrown across the road. Such is the description of a length of about 80 feet on the north-western side of the avenue. On the south-eastern side only one tree was blown down, and that was directly opposite the higher of the two last mentioned uprooted elms. These facts seem to show that the centre of the whirlwind where the four tall elms were left standing uninjured was comparatively powerless—that its great strength was between 30 and 40 feet from its axis—and that its eastern side, by which the three last mentioned trees on opposite sides of the avenue were prostrated, was more powerful than its western side; this last circumstance being due, probably, to its rotating north, east, south and west, as it advanced southward; for the rotatory motion, and the progressive motion would be thus combined on its eastern side to form its maximum power. Similar effects were produced by the whirlwind a mile and a half south of Trevayler, on its reaching the entrance gate of Alverton House, at the west end of Penzance. A large elm about 30 feet eastward of that gate, and another tree about 20 feet westward of the gate, were blown down; but the intervening tall elms were left uninjured. In the same manner it passed through the orchards, south of Alverton House, rooting up the apple trees on its east and west, but leaving those in the middle of its path scarcely damaged. A woman was caught in it close by Alverton gate, but as she happened to be near its centre she escaped unhurt although unable to breathe for a few seconds from the violence of the wind. Here, too, as at Trevayler, the eastern side of the whirlwind appeared more powerful than its western. And it is very remarkable that at Trevayler and Alverton *all* the trees overturned, whether by the eastern or by the western side of the whirlwind, were prostrated with their heads towards the south or between south and south-east.

That they should have been prostrated in that direction by the eastern side of the whirlwind I can readily understand, considering that it rotated north, east, south and west; but why those blown down by its western side should have been prostrated towards the south, or between south and south-east, I cannot conjecture; and I have not time at present to refer to any work for an explanation.

The whirlwind, after passing close above Higher Lariggan House, and destroying part of a field of cabbage or brocoli plants, as if a harrow had been drawn over them, proceeded down the hill to Zimmerman's cot, in the orchards of which it overturned some fruit trees, and snapped asunder the trunk of a large ash close by the road and stream running from Trereife smelting-house to Newlyn. Beyond this spot it appears to have continued its course in the same direction to the sea without doing much further damage. On the following day (the 15th of December), as stated in the newspapers, the shock of an earthquake was felt at Patelybridge and other places in Yorkshire. The snow which set in at Penzance on the day of the whirlwind, continued there for a week—a very unusual length of time for this town. "The intense frost, (says Mr. Lowe, of Highfield House,) which set in with a rough north-north-west wind on the 14th of December (the day of the whirlwind) reached a degree of cold on the 17th and 18th greater than ever recorded there in the month of December, since 1841."

The earthquake shock through nearly all Cornwall on the 13th of January, 1860, at 10.32 p.m. (local time) during a squally and unusually dark night, appears to have been the severest recorded in this county. It was felt at great depths underground in several mines, very distant from each other, although not in any of the mines of St. Just. On the surface, however, in almost every locality the persons who felt it were probably twenty times more numerous than those who experienced the shock of the 21st of October. I am not yet prepared to give a full account of it, but hope to be so at the next annual meeting of the Royal Geological Society of Cornwall.

Penzance, May 5, 1860.

## APPENDIX V.

## ON THE NIDUS AND YOUNG OF PONTOBDELLA MURICATA, &c.

By C. W. PEACH, Esq.,

*Member of Phys. Soc. Edinb: and Corr. Member R.I.C.*

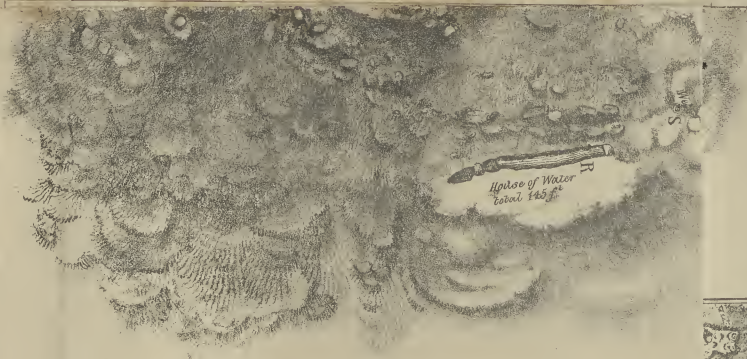
In this communication the author describes the circumstances of his finding the young of this Annelide in its nidus, having the form of the adult worm, proving that it passes through no change after it leaves the egg. This nidus had been noticed, he afterwards found, by Sir J. Dalzell, some years ago, who had published an account of it.

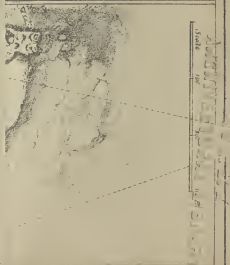
In regard to the forms of the young of Annelides, Mr. Peach refers to his observations published in the Institution Reports for 1849 and 1850, respecting the Nercis bilineata; and goes on as follows:—"When turning up stones between tidemarks, in March, 1852, I observed blueish masses of jelly like matter, in which light yellowish spots showed through the transparent envelope; at first I thought the masses of the ova of shells, or of medibranchs; but on examining one carefully, I observed that at each end of the elongated mass there was an opening, and I fancied I could see something moving; on passing my knife under it, a small dark olive-green iridiscent worm, eel-like, glided out; this I secured, and found to be a Nemertes, probably *Nemertes gracilis*, so abundant under stones, where dark decomposing vegetable matter is mingled with the sand. From year to year, ever since, I have noticed these jelly-like masses, with their attendant worms.

The ova are arranged in two rows, and may be seen through the glairy mass, arranged in trefoil like groups. These masses are from two to three inches in length, and about one-fourth of an inch in thickness and breadth. They are very tough and elastic.

Wick, N.B., 4th May, 1860.

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House of Water
total 145 ft
N
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*REFERENCES*

A T. Gateways of main wall.
B. Outer Gateway
C. Stones erect
C G. C G. Mounds partly of later time
D. Inner Gateway
E. Rock supposed by Borlase to be a Seat of Judgment
F. Stones erect
G. One of the outer walls
H. Outer walls.
I. J. Outworks & wall
K. Rock cut long ago for a millstone near it natural basons.
L. M. P. Q. X. Main wall
N. Natural bason in the rock
O. S. Wells
R. Heaps of water of great depth.
U. Rock with basons.
Ua. Ub. Supposed wall of Citadel.
V. Supposed Giant's Hand.
W W. Outer wall & Ditch.
Y. Masonry Z. Upright Stones.

# CARN BRÊ, or Carn Brea.

near REDRUTH.

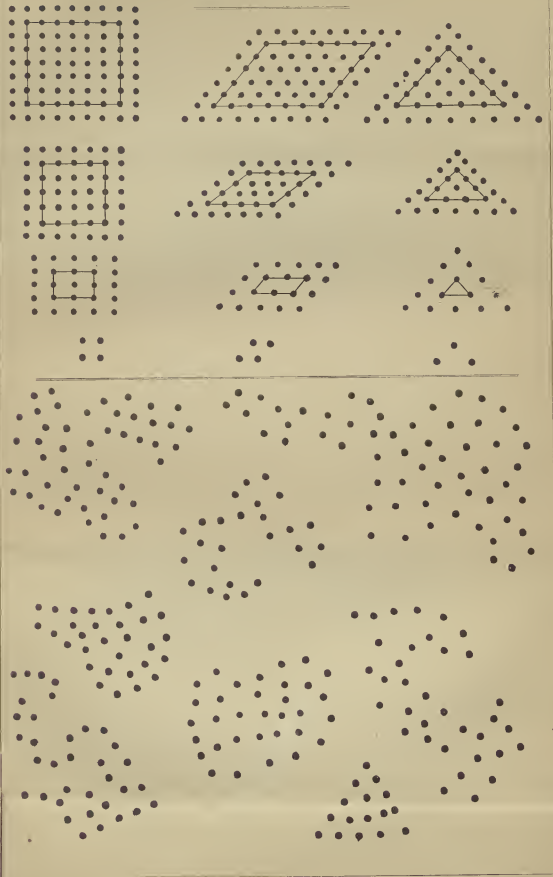
by

Sir Gardner Wilkinson D.C.L. F.R.S. &c.

Scale of Feet.

50 0 100 200 300 400 500

SKETCH PLAN IN ILLUSTRATION OF
Mr ENYS'S PAPER.



Heard & Sons Lithographers Truro

ERRATA.—In Mr. Enys's Paper, page 46, six lines from bottom, for "fern," read "thorn;" at page 48, line nineteenth, for "buttocks" read, "futtocks;" at page 49, twelfth line from bottom, for "glens, of," read "gleams of;" and at page 50, line three, for "sun, and in," read "sun and air in."